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INFORMATION PROCESSING MODELS OF PEER NOMINATIONS.(U)
JUN 78 A Y LEWIN, S S LAYMAN N00014-76-C-0007
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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: Technical Report No. 7
2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle): (6) Information Processing Models of Peer Nominations.

5. TYPE OF REPORT & PERIOD COVERED: (9) Progress rept.,

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s): (10) Arie Y. Lewin and Shelley S. Layman

8. CONTRACT OR GRANT NUMBER(s): N00014-76-C-007 (15) N00014-76-C-0007

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Graduate School of Business Administration
Duke University, Durham, North Carolina

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: NR170-805

11. CONTROLLING OFFICE NAME AND ADDRESS
Organizational Effectiveness Research
Office of Naval Research
Arlington, VA 22217

12. REPORT DATE: (11) Jun[redacted]78

13. NUMBER OF PAGES: 35

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

15. SECURITY CLASS. (of this report): Unclassified (12) 37p.

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

NA

18. SUPPLEMENTARY NOTES

This paper is a second revision of Technical Report #4. It is forthcoming in Personnel Psychology.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Peer Nominations	Leadership
Protocol Tracing	Decision Process Models
Information Processing	Attribution Theory

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This research presents results regarding the development of an information processing theory of the judgemental process in which individuals engage while rating their peers. The approach taken was to utilize protocol tracing methods to construct decision process models of how individuals rate their peers on seven widely used sociometric questions. The protocols revealed that individuals evaluated their peers along five primary behavior categories: (1) Mutual Influencing, (2) Categorizing/ → next page

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S/N 0102-014-6601

78 06 08 057

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409 684

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AD No. _____
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Summarizing, (3) Social-Directive, (4) Quanitity of Verbal Communication, and (5) Listening. Models for each sociometric question were constructed and tested by comparing the models' prediction with the actual group peer ratings. Using first order models only, high rank correlations (r_s range up to 1.00) were obtained between the peer rankings predicted by the models and the actual peer rankings. Implications of the results to research on person perception and the attribution of leadership are also discussed.

Information Processing Models of Peer Nominations

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I P Models

Revision 4.2

Abstract

This research presents results regarding the development of an information processing theory of the judgemental process in which individuals engage while rating their peers. The approach taken was to utilize protocol tracing methods to construct decision process models of how individuals rate their peers on seven widely used sociometric questions. The protocols revealed that individuals evaluated their peers along five primary behavior categories: (1) Mutual Influencing, (2) Categorizing/Summarizing, (3) Social-Directive, (4) Quanitity of Verbal Communication, and (5) Listening. Models for each sociometric question were constructed and tested by comparing the models' prediction with the actual group peer ratings. Using first order models only, high rank correlations (r_s range up to 1.00) were obtained between the peer rankings predicted by the models and the actual peer rankings. Implications of the results to research on person perception and the attribution of leadership are also discussed.

Decision Process Models of Peer Nominations*

Introduction

In their review of the literature on peer nominations, Lewin and Zwany (1976) concluded that "peer ratings have been empirically shown to have high validity in the prediction of diverse future performance criteria" (p. 423). They noted a lack of theory in this area, and that there was a need for an explanatory theory of the actual peer rating process. Following the research paradigm proposed by Lewin and Zwany (1976), empirical descriptive/predictive models of the peer nomination process are derived. Utilizing protocol tracing methods, decision process models were constructed of the thought process individuals engage in while rating their peers on seven widely used sociometric questions.

*This research was supported by Research Grant No. N00014-76-C-007 from the Office of Naval Research.

The authors wish to acknowledge Daniel Basmajian and Linda Meyer for their assistance in scoring the videotapes and statistical calculations on the data. The contribution of Cheryl Rogers in the manuscript preparation is also greatly appreciated.

Protocol Tracing and Information Processing Models

Part of the difficulty in developing a model of decision process behavior comes from the empirical procedures often employed. In previous research on decision behavior, the subject is viewed as a "black box." In other words, focus has been directed toward the end product of the decision process and not on the actual process of how the subject reached the decision. The question always remains as to what information is being processed in the subject's mind?

Slovic and Lichtenstein (1971), in their review of the literature dealing with the modelling of human decision making, concluded that: "The evidence to date seems to indicate that subjects are processing information in ways fundamentally different...[from those of the traditional regression and Bayesian approaches]....we will have to develop new models and different methods of experimentation." (p. 729). They suggest a promising strategy for the development of a theory of human judgement - - the technique of cognitive process modelling.

The theory and empirical research on information processing can be traced to the work by Newell, Shaw and Simon (1957). Their theory is built on the premise that such processes as thought, verbal behavior, and problem solving behaviors are performed as sequential information processing steps. These "elementary processes" consist of such operations as: storing information in familiar symbols or "chunks", retrieving it, moving it, generating transformed data, comparing two symbols for equality, and associating two symbols. In other words, these elementary processes are simple logic manipulations of strings of data.

The basis of cognitive process modelling theory is that individuals solve a problem by first developing a problem space -- a psychological representation of the task environment. Intelligence, the information available to an individual from his memory, and the objective task environment determine the problem space. The space is searched for a solution by means of a program, that is, the individual will operate upon his information until he achieves his goal. The fundamental limitation on this solution process is the ability of the individual to store data in a dynamic (quickly alterable) memory. Newell and Simon (1972) conclude that individuals cannot store more than five to seven symbols in a dynamic memory; therefore, one expects to find no more than five to seven dimensions to a problem which will be considered, no matter what its complexity. Actually, individuals usually consider fewer than five aspects of a problem. Newell et.al. (1972) contend that abstractions from "reality" characteristically involve perhaps only two symbolic representations at any given time.

Cognitive process programs are constructed from information elicited by a subject while performing a task. One method of collecting this information is by obtaining a verbal self-report from the subject as he solves a problem. This record of the subject's reported thought process is known as a protocol. The value of this method of obtaining the decision process behavior, has been noted by Simon (1976): "....[a] technique....used to increase the density of observations of the information-processing system stream [is] recording think-aloud protocols of the problem solver's verbalizations during his activity." (p. 28).

Similarly Payne (1976), in an analysis of the various models of decision making, concluded that asking subjects to "think aloud" while making their decisions, provides valuable insights into the information processing strategies which led a subject to make a particular choice. Newell (1966) has developed a methodology for the analysis of protocols based upon content analysis. His procedure allows for the discovery of the patterns of thought which underlie behavior.

The strategy used in this study was to derive descriptive/predictive models of the peer nomination process using protocol tracing techniques. In other words, this approach involves developing decision process theories from an analysis of the data - verbalized statements of the subjects' thought processes obtained while making actual peer judgements.

Method

The procedure used in this study was adapted from Akula (1969). The experimental environment simulated managerial decision making. Subjects were organized into ten seven-person* teams assuming the role of management consultants in a project staff meeting. The nature of the task required the team members to analyze a hypothetical company, described in a general management case, and prepare preliminary recommendations to the company.

*Group 6 was composed of five members, and Group 9 had six members.

Subjects

The 67 paid volunteers were undergraduate students at Duke University. The sex mix was not controlled resulting in a random distribution of males and females for each of the ten test teams. Prior acquaintanceship was minimized as much as possible. However, two friends did participate in the same group in two of the test sessions.

Stimuli

The stimuli was a peer evaluation questionnaire. It consisted of seven items selected from those that Hollander (1965), Weitz (1958), and Roadman (1964), found to be valid predictors of managerial success and future performance. The questions were as follows:

1. Who would you prefer to go to for help on a tough problem? (Weitz)
2. Who is pulling most for the group? (Weitz)
3. Who is best at handling people? (Weitz)
4. Who has the most ability to think critically and analytically? (Roadman)
5. With whom can you work best? (Weitz)
6. Who shows the greatest independence of thought? (Roadman)
7. Who has the best overall leadership qualities? (Roadman)

Subjects were asked to exclude themselves and rank the members in their group from first to last on each of the questions.

Although the set of questions in the peer rating instrument consisted of seven items, each questionnaire booklet contained only six of the seven sociometric measures, with one question systematically omitted from each booklet. The procedure was constructed in such a way that the subject would have an unfamiliar question for which to give a protocol. In order to achieve an equal number of protocols for all seven measures, the omitted question alternated in each booklet.

Procedure*

Subjects were seated in a semi-circle facing the videotape camera. Each management simulation consisted of six phases:

(1) Subjects received an orientation. They were told that they were involved in an exercise examining how a group approaches an unstructured problem situation. Each phase of the exercise was briefly described and they were informed that their group discussion would be videotaped.

(2) A general management case describing a hypothetical company was distributed with approximately 20 minutes allotted for individual reading of the case.

(3) Subjects were told that they were to convene as a project staff meeting to prepare preliminary recommendations to the hypothetical company. To insure that no one was predesignated as the group leader, they were informed that the project team leader was called away on urgent business. The videotape was started and the discussion was terminated after 30 minutes.

(4) The videotape of the group discussion was replayed for the purpose of letting the subjects see how they functioned as a group and to refresh their memories as to what was said.

*For complete details see Lewin and Layman (1977).

(5) Interest in the replay was usually lost within 15 minutes, wherein the peer evaluation instrument was distributed and completed.

(6) After the questionnaire was completed, each subject was taken into a separate office for the purpose of providing a protocol. At the start of the session permission was obtained for recording the protocol. The subject was told that the researchers' main interest was in the thought process involved in making a decision. He or she would be asked to think aloud, to verbalize his thoughts, as he ranked his group members on another question (the sociometric omitted from his questionnaire booklet). He was instructed to say whatever came into his mind, however silly, impolite, irrelevant, fragmentary or unimportant. In addition, the subject was advised that whenever he should fall silent for more than a moment, he would be asked "to please talk...."

A practice question was given to familiarize the subject in verbalizing his or her thoughts. The practice session included a review pointing out where, and how, the subject failed to report verbally his entire chain of thoughts. The relevant experimental sociometric question was then presented, and the subject was told to exclude himself and rank the members in his group from first to last, verbalizing everything that he is thinking.

During the subject's verbal report, the researcher would take note of what appeared to be nonoperational statements or code words for complete thought process strings which the subject would verbalize in his evaluations. Examples are the use of code words such as "intelligent," "friendly," etc. The operational meetings of these words or phrases were explored with the subject at the conclusion of the session, then he or she was debriefed and paid.

Results

Protocol Analysis

A complete transcript of the verbal reports given by each subject was made. Using the procedure suggested by Newell and Simon (1972), the protocols were broken into short phrases each representing the subject's assessment of how he or she was ranking a person a particular way. According to Newell and Simon (1972), breaking verbal protocols into small phrases "goes a long way towards isolating a series of unambiguious 'measurements' of what information the subject had at particular times." (p. 166).

Once the protocols were isolated into short phrases, they were analyzed for operational and nonoperational information processing des-

criptors of the subject's thought process. Operational descriptors refer to statements about behavior which are tangible, observable and measurable. For example, the statement "agreed with me" is defined as operational because it connotes a specific agreement, which can be reliably scored. It is also possible to signify agreement with a nonverbal communication which can also be reliably scored (e.g. head nodding). However, the statement "he seemed personable" is considered to be a nonoperational verbal descriptor. It does not suggest any specific behaviors which the person being described, engaged in, that make him "personable."

Group Videotape Content Analysis

From the analyses of the protocols, 18 verbal content categories* (information chunks) were identified, (e.g. gives direction, summarizes, asks questions, etc.) These categories -- suggested by the protocols as being the chunks of information used by an individual in making a decision -- were then used as the basis for analyzing and scoring the content of the videotaped group interactions. Initially, only verbal communications were content analyzed and scored. It became evident, however, that subjects were also processing a variety of nonverbal cues for which no operational definitions were available. Subjects for example evaluated the extent to which other group members were "listening", seemed "open and relaxed", and so forth. A study of the nonverbal literature (Knapp, 1972; Mehrabian, 1972) indicated that nonverbal dimensions (e.g. responsiveness, dominance, immediacy, etc.) could be reliably scored and thereby significantly increase the subset of information being processed by the subjects.

*Not all content categories appeared in every protocol. See Lewin (1977) for a complete description of the verbal and nonverbal content categories.

Searching the record of the verbal transactions for these content categories in each group videotape involved three steps:

1) A sequential list of the order of speakers was made by two observers who independently recorded this information, after which the two lists were cross checked and reconciled.
2) The audio of each videotaped discussion group was transcribed and the verbal comments were analyzed and scored as to which content category they belonged. For example, the statement "Yes I agree, and what you said could also apply to Marketing because....", would be scored as an agreement, and as building on a previous statement.
3) The videotape was scored for nonverbal communications, (e.g. head nodding, listening, eye contact, etc.). It was viewed with and without sound for greater concentration on the nonverbal expressions (Heimann & Heimann, 1972). These categories were independently scored by two observers.*

From this record of the communications, each individuals' contributions were extracted and summed. In other words, for each subject a record was made of the number of times he agreed, disagreed, expressed an opinion, etc. This data was then used as inputs to the peer ranking models for predicting how a subject would be rated on each sociometric by the group.

*The median interrater agreement was .98 with a range of .964 to .998.

Decision Process Models

No a priori models of the subjects' decision behavior were postulated in this research. The protocol tracing methodology is intended to provide process descriptions of the information processing strategies employed by subjects while evaluating their peers. It was expected that a content analysis of the descriptors (operational and nonoperational), obtained from the decomposition of each protocol, would identify a few key dimensions which subjects considered in evaluating their peers. Based on prior research and a review of the literature (Lewin and Zwany, 1976) it was expected that these dimensions would be situationally common for a particular sociometric question. In other words, we expected to identify a common pattern of thought which was shared by the Duke subjects when evaluating their peers on a particular sociometric question.

The development of the models involved identifying the information chunks being processed, and the decision rules for combining these pieces of information used to make predictions of the group peer rankings.

From the extracted information chunks of the protocols, several recurring themes were gleaned. A frequency analysis of these phrases suggested the following primary factors: (1) a Mutual Influencing exchange (MI), (2) having the ability to Listen (L), (3) the Quantity of Verbal Communication (QVC), (4) engaging in a Social-Directive role (S-D) and (5) Categorizing and Summarizing information (C/S).

The Mutual Influence factor is identified by the existence of three behaviors: (1) a give and take exchange, (2) having the ability to listen, and (3) not being overly dogmatic or aggressive in ones views. A give and take exchange is represented in the protocols* for example, by the following underlined descriptors:

*For a sample of a complete protocol transcript see Lewin (1977).

S_1: ...he can expound a bit more intelligently
on my ideas.
There is a give and take between us.

S_2: We were jointly finding solutions.

S_3: I agree with what she said,
but I could persuade her to my way of thinking sometimes,
if we disagreed.

The descriptors in a give and take exchange include those which indicate agreement, disagreement and building on anothers idea.

The listening aspect of the mutaul influencing process is evident in the following descriptors:

S_1: He responds to what people say
and draws my thoughts into the group.

S_2: She's willing to listen to you,
and I don't think she'd dominate
or restrict me from adding my side.

It is logical that in order to have give and take, each person involved in the discourse must be a listener as well as a contributor to the discussion.

Following Rokeach's (1954) definition of dogmatism, the dogmatic person can be described as closed-minded, rigid, and intolerant of other's opinions especially when they differ from his own beliefs. This quality was evident nonverbally through such cues as rigid body posture, crossed arms, leaning backward outside of the group, etc. These persons were perceived as being cold, aloof, and not open to persuation. Dogmatism and aggression was described in the protocols by such verbal descriptors as:

S_1: She interrupts

S_2: He was overly aggressive and dominated the conversation.

S_3: I felt like he would come down hard on someones negative opinions, and he wouldn't be tactful when he disagreed.

This rigid, aggressive, and dogmatic quality was primarily scored through the nonverbal cues by two independent observers; it was then combined with the count of verbal statements of disagreement, agreement, and building expressed by a subject to obtain the final Mutual Influence score.

Mutual Influence was found to be of primary importance in the sociometric "With whom can you work best?" The existence of give and take, listening, and the absence of dogmatic-aggressive behavior are all combined in the decision of the peer rankings on this question. This factor was also found to be important in the protocols on "Whom would you go to for help on a tough problem?", "Who is best at handling people?", and "Who shows the best overall leadership qualities?" Curiously enough, however, the components of give and take and listening were represented, but little mention was made that the restrictive nature of the dogmatic-aggressive individual was undesirable on these three sociometrics. Therefore, the Mutual Influence score used on these three sociometrics included the give and take exchanges only.

The factor of Listening was apparent in both the verbal and nonverbal communications. It is revealed verbally, for example, in the following exerpts from the protocols:

S_1: She listened and spoke.

S_2: He didn't interrupt when someone else was talking.

Nonverbal cues include eye contact, head nodding, leaning forward toward the speaker, etc. Listening was scored by two independent observers who viewed the videotapes without the sound (Heimann & Heimann, 1972) in order to focus more closely on the nonverbal cues. The Listening factor was found to be particularly important in the sociometrics "Whom would you go to for help on a tough problem?", and "Who is pulling most for the group?"

The factor of Categorizing or Summarizing is exemplified by the following descriptors:

S_1: I would say something
and she seemed able to draw it together,
...like I'd come out with generalizations
and she'd categorize it
and put it sort of into a pocket,

S_2: He was able to look at both sides of the
situation and reach a conclusion.

Each time a subject made a statement which tied two ideas together, review what had already been said, etc., it was scored as a Catagorizing/Summarizing behavior. This factor was most frequently expressed in the sociometric "Who has the most ability to think critically and analytically?"

The factor of the Quanity of Verbal Communication (QVC) is described in the protocols by such descriptors as:

S_1: He talked the most

S_2: She had the most ideas, she contributed the most,

This factor was scored from a count of the number of utterances made by each subject. A finer classification of the QVC was made using the number of opinions stated by an individual as a subset. This measure of verbal participation proved to be a more significant measure and therefore, was used whenever "talkative" appeared frequently in the protocols on a particular sociometric. This factor was found to be important in making peer rankings on the sociometrics "Who is pulling most for the group?" and "Who has the most ability to think critically and analytically?"

The Social-Directive factor characterizes the individual who organizes and gives direction to the group, and accomplishes this in a socially acceptable manner. A person ranking high on this dimension organizes the group and structures its problem solving process, and at the same time is sensitive to the other group members. This includes listening, drawing others out, not imposing one's will, etc. These behaviors are illustrated in the following descriptors:

S_1: He started the whole discussion off
and got things going at the beginning.

S_2: He gave the group structure,
told us when to move on,
assigned someone to take notes,
asked questions of the group
and of people who weren't talking
to draw them out.
He pushes his ideas over in a pleasant way,
and when he spoke we listened.

S_3: She didn't just sit back all the time
but she wasn't beligerent
in expressing her views either.

This parameter was scored by combining two factors. First, each member was ranked on Direction. This included a count of the verbal communications which organized and gave structure to the problem solving process of the group (i.e. keeping the group on track, categorizing and summarizing information, taking a comprehensive view of the situation, etc.) Second, each member was ranked on Listening by two independent observers as described previously. Because it was not possible to determine specifically what is meant by "socially acceptable" behavior, the nonverbal Listening factor was used as a surrogate measure. It represents such qualities as attentiveness and consideration of other group members. Social-Directive descriptors appeared most frequently in the protocols on the sociometrics "Who was pulling most for the group?", "Who is best at handling people?", and "Who shows the best overall leadership qualities?"

The primary factors which were employed in the models for each sociometric question and the frequency with which these factors occured in the protocols are summarized in Table 1.

Insert Table 1 about here

Although our objective was to obtain both the information chunks and the decision rules used in making the peer judgements, analysis of the protocols identified only the information categories and did not indicate to us how the chunks were combined. Therefore, a simple unweighted additive model was applied.

The success and accuracy of linear models employed in a variety of contexts has been well recognized (Slovic & Lichtenstein, 1971; Dawes & Corrigan, 1974; Einhorn & Hogarth, 1975; and Simon, 1976). Wanous and Lawler (1972) for example, conducted an experiment testing nine models of job satisfaction. They concluded that the simplest unweighted model of job satisfaction was as good and in several cases better than the models where facet satisfaction was weighted by importance.

The application of linear decision rules can be illustrated using the sociometric question "Who would you prefer to go to for help on a tough problem?" Once the primary parameters are identified from the protocols, in this case they are Mutual Influence and Listening, the decision rules for peer rankings would be to: (i) rank each group member according to the additive score of "agreements," "disagreements", and "building", since these factors compose the Mutual Influence parameter; (ii) rank the group members on the nonverbal cues indicating Listening; and (iii) combine the two rankings. This final ranking is then statistically compared to the actual aggregate group rankings. Similar ranks were developed for each sociometric question.

Testing the Models

Based on the information processing rules illustrated above, predictions were made for each group as to their rank order on each of the sociometric questions. The Spearman rank correlation between the model predictions and the actual peer rankings was calculated for each sociometric question. Table 2 summarizes the results. The r_s values are shown for the protocol analysis derived model, and an alternative model -- those instances where another model proved to be equally as good or better.

Insert Table 2 about here

Overall, the predictive power of the models developed from the protocol analysis is high. It appears, however, that for two of the sociometrics equally good or better predictors are obtained using simpler models than those derived from the protocols analysis. For example, the model using the Listening factor by itself appeared to be better for the sociometric "Who would you go to for help on a tough problem?" Using the criteria that the higher the Spearman r_s values the better the rank correlations, six of the nine groups had higher r_s values using this simpler model over the protocol derived model which was composed of the Listening and Mutual Influence factors. Also, the model using the Quantity of Verbal Communication factor only, appeared to be superior to the protocol analysis model for the sociometric "Who has the ability to think most critically and analytically?"

The Spearman rank correlation is a good indicator of a model's predictive power for a particular group, however, it is not sufficiently sensitive to make a choice between models, for a sociometric, over all groups in general. This is due to the fact that the r_s is calculated for each individual group and thus the models are not evaluated over all of the groups in the aggregate. One method to determine which models (the alternate or protocol derived) are best over all groups is to perform a comparative frequency analysis of the model deviations from the actual aggregate peer rankings. Using the same data, a calculation is made of the frequency for which there was a perfect match between a model and the actual aggregate peer ranks, overall groups, where the model precition was off by one adjacent rank, off by two ranks, etc. In selecting which model is best on a particular sociometric, the criterion might be that model which minimizes the overall deviations. Table

3 summarizes the rank deviations for each sociometric models, and those instances where appropriate, for the alternative model. The sum of the squared deviations is least for those models which are starred. This method supports the results found previously, indicating that the models with the highest $\underline{r}_{\underline{s}}$ scores also have the least squared deviations and are therefore superior over all groups.

Insert Table 3 about here

These models, derived through protocol analysis, are predictive of the behaviors in which an individual would engage in order to be ranked high on a particular sociometric by his or her peers. For example, a subject ranked high on "Who would you prefer to go to for help on a tough problem?" would often engage in behaviors which indicate nonverbal listening (e.g. head nodding, good eye contact, etc.). To be ranked high on the sociometric "Who is pulling most for the group?" a subject would have to talk frequently and give direction to the group while being considerate of the other group members (e.g. drawing others out, listening, etc.) In order to be regarded as "best at handling people," an individual would not only have to give direction in a socially acceptable manner, but he/she would also have to engage in mutual influencing exchanges with other group members (e.g. give and take as seen by agreeing, disagreeing and building on previous statements). The group member who expresses the most number of opinions would be judged by his peers as having "the most ability to think critically and analytically." The model for the sociometric "With whom can you work best?" indicated that the group member who

frequently engages in mutual influencing exchanges with the other members and does not attempt to dominate or restrict the discourses is ranked highest by his or her peers. Finally, to be considered as having the "best overall leadership qualities" a subject would have to organize and direct the group, and have a mutual influencing relationship with the majority of the other group members.

Discussion

The results to-date can be viewed as strongly supportive of the experimental approach taken in this research. The protocol derived models appear to capture the essential information being processed by the subjects, and they are basically supportive of the human problem solving theory proposed by Newell and Simon (1972). The effectiveness and simplicity of these information processing models -- with regards to the few and operationally defined variables -- are encouraging as to their potential implications for decision process modeling research on other problems of person perception within an organization (e.g. managerial selection and assessment).

Surprisingly, it appears that even simpler predictive peer rating models exist than those derived from the protocol analysis; particularly in those instances where nonverbal communication is a primary factor. For all of the sociometrics, (except for the question concerning critical and analytical thinking) the processing of nonverbal cues was a crucial component in forming a judgement. For example, the primary parameter, as indicated by the protocols, for the sociometric "With whom can you work best?" is Mutual Influence. This factor combines information obtained from processing (1) verbal communications (i.e. those interactions which connote give and take: agreements, disagreements, and building); and (2) nonverbal communications (i.e. dogmatic-aggressive characteristics: rigid body posture, poor eye contact, no head nodding, etc.) Table 4 shows the $\underline{r}_{\underline{s}}$ scores for the Mutual Influence factor first computed using the verbal give and take communications only, and second with the nonverbal dogmatic-aggressive behaviors added.

Insert Table 4 about here

It is clear from the increase in the significance of the r_s values when the nonverbal communications are included in the Mutual Influence score, that nonverbal cues are important pieces of information considered by the subjects. Using a two-tailed t test the two series of r_s values are significantly different at the .01 level.

A possible explanation for the dominance of nonverbal information in these IP models may be obtained from a further examination of the group situation itself. In such a group discussion with six other individuals to interact with and judge, it is possible that an information overload may be occuring. For example, in order for a subject to rank the six members of his group on the sociometric "With whom can you work best?" he/she would have to (1) recall the give and take exchanges, i.e. how many times each member agreed, disagreed and built on his ideas; (2) recall the various nonverbal cues elicited by each member indicating dogmatism, aggression and listening; (3) add this to his count of give and take exchanges; and (4) finally arrive upon a ranking for all six members.

Therefore, it seems likely that, in such an information rich environment, a subject makes an attribution on a person's ranking on these sociometrics using nonverbal information as a surrogate for processing a detailed account of all the verbal transactions. It is possible that persons form opinions of their peers early in the communication and rely thereafter primarily on the nonverbal, rather than the verbal, information. Prior research has shown (Lewin, Dubno, & Akula, 1971; Hollander, 1956a, 1957, 1965) that valid and reliable peer evaluations are obtainable in relatively brief interaction times. This is an interesting research question which needs to be further explored.

Listening behavior appears in the literature in two forms, as a nonverbal communication (e.g. Knapp, 1972; Mehrabian, 1972; Nierenberg & Calero, 1977), and as a verbal communication (e.g. Bavelas, 1948; Leavitt, 1951; Thibaut & Kelley, 1959; MacKenzie, 1966a, 1966b). Though previous research typically is focused on only one form of listening, it is evident from our study that subjects perceive and process both aspects of listening, are able to distinguish between verbal and nonverbal communications of listening, and applied the two forms depending upon the situational context. The protocols indicated that the verbal form of listening deduced, for example, from mutual influencing exchanges is important in order to obtain a high ranking on the sociometrics, "With whom can you work best?" and "Who shows the best overall leadership qualities?", while nonverbal listening cues, such as eye-contact, head nodding, and body positioning, were found to be particularly important in determining the peer rankings on "Whom would you go to for help on a tough problem?"

Another important finding is the commonality of the underlying IP models for the sociometrics. Our results demonstrate the existence of shared implicit models among the subjects of our study. The existence of such shared models of behavior has been previously suggested by other researchers (e.g. Secord, Dukes & Bevan, 1954; Bem, 1967; Lewin, Dubno & Akula, 1971), though it has never been empirically demonstrated.

Our research findings are also relevant to the literature describing the emergent leader of a group as that member who talks most frequently, independent of the content of his verbalizations (Bass, 1949; Norfleet, 1948; Bales, 1953; Borgotta & Bales, 1956; Kirsh, Lodahl & Haire, 1959; Riecken, 1958; Regula & Julian, 1973). Sorrentino and

Boutillier (1975), for example, investigaged the relationship between quantity and quality of verbal interaction on the leadership process. Their results indicate that while quality of verbal interaction was found to predict perceived differences on such variables as competence, influence, and contribution to the group's goal, only quanity of verbal communication predicred perceived differences in leadership ability.

Our data lends itself for further testing of Sorrentino and Boutillier's (1975) results. The complete record of the verbal transactions -- the number of words spoken, time length of the verbalizations, and the content and order of communications -- enabled us to test the relationshiop between the quantity of verbal communications and the rankings on all sociometrics. Specifically, we measured the quantity of verbal interaction by the number of utterances and by the number of opinions stated. Neither of these measures were significant in predicting the peer ranking criterion for any of the sociometrics except one -- "Who has the most ability to think critically and analytically?" The relationship between the quantity of verbal communication and the peer rankings for the question "Who shows the best overall leadership qualities?" is of particular interest in view of the Sorrentino and Boutillier (1975) findings. No correlation was found between the ranking based on the quanity of verbal communication and the actual peer rankings for this question. This is not surprising, however, since quanity of verbal communication was not frequently mentioned in the protocols as being an important leadership quality for our subjects.

The findings of this study also have implications to the large body of research on leader behavior. Specifically, they indicate that judgements about leadership may be the outcome of an attribution process, that the causal models undergirding the attribution process may be common to a specific population, and that the models may include variables not pre-

viously suggested in the literature. The Mutual Influence factor is an example of this latter point. It is not given specific attention in such leader behavior theories as Path-Goal, Contingency or Consideration and Initiating Structure. Hollander (1976) has also noted the importance of a similar factor in the leadership process when he refers to a "transactional" social exchange. This "has to do with the leader-follower relationship in the aggregate, including the followers perceptions and expectations, the availability of two-way influence, and exchange rewards" (p. 1). Our findings not only indicate that a mutual influencing exchange is a vital component in one-to-one relationships, but that it is also important for a leader to have this type of exchange with the majority of the group members in order to emerge as the leader.

Our findings also serve to amplify and support previous research on leader bahavior. The descriptors of the Mutual Influence factor for example, clearly suggest that the two elements of participation -- participative decision making and participative supervision -- are components of Mutual Influence, with the distinction that attempts to influence are initiated by both individuals without being overly dogmatic and aggressive in ones views. In addition, descriptors of the Social-Directive parameter e.g. "initiates the discussion," "tries to get responses from other people," "brings group back on track," "gives the group structure, assigns various tasks," "pushes over ideas in a pleasant way," "able to look at both sides and reach a conclusion", etc. clearly suggest that aspects of the Consideration and Initiating Structure dimensions are represented in this parameter. At the same time the behavioral descriptors of the S-D parameter extend the operational and nonoperational meanings of these two dimensions.

In sum, the goal of this research was to utilize protocol tracing techniques to empirically derive and test descriptive/predictive models of the thought process in which individuals engage while rating their peers. Overall, the results are supportive of the feasibility of applying information processing methods to derive and operationalize person perception theory in general, and in particular, the peer nomination process. The methodology also allows for a direct testing of other kinds of behavioral parameters (e.g. the importance of nonverbal listening, the quanity of verbal communication, etc.) Finally, our research findings suggest the need to approach leadership research as an attribution process.

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Table 1

Summary of Key Parameters for each Sociometric Question

Sociometric	Primary Factors	Frequency Stated in Protocols
1. Who would you go to for help	MI	32%
on a tough problem?	L	32%
2. Who is pulling most for the	S-D	27%
group?	L	27%
	QVC	24%
3. Who is best at handling people?	S-D	42%
	MI	31%
4. Who has the most ability to think	QVC	33%
critically and analytically?	C/S	33%
5. With whom can you work best?	MI	60%
6. Who has the greatest independence	No clear	
of thought?	indication	
7. Who shows the best overall	S-D	48%
leadership qualities?	MI	32%

Table 2

Summary of Spearman Rank Correlation between Actual Aggregate Peer Rankings and Predictions based Upon the Models

Sociometric & Models	Groups +								
	1	2	3	4	6[a]	7	8	9[b]	10
1. Who would you go to for help on a tough problem?									
Model: L + MI	.830*	.669	.875*	.758*	.975*	.937**	.633	.642	.758*
Alternative Model: L	.919**	.785*	.928**	.785*	.625	1.000**	.893**	.642	.571
2. Who is pulling most for the group?									
Model: S-D + QVC	.847*	.768*	.938**	.964**	1.000**	.821*	.929**	.029	.634
Alternative Model: S-D	.946**	.946**	.928**	.991**	.700	.955**	.964**	.486	.875*
3. Who is best at handling people?									
Model: S-D + MI	.777*	.705	.777*	.571	.925*	.286	.946**	.486	.938**
Alternative Model: S-D	.830*	.714*	.777*	.598	.975*	.813*	.964**	.486	.875*
4. Who has the most ability to think critically and analytically?									
Model: QVC + C/S	.821*	.535	.964**	.964**	.725	.785*	.830*	.414	.705
Alternative Model: QVC	.964**	.928**	.964**	.883*	.900*	.750*	.830*	.514	.705
5. With whom can you work best?									
Model: MI	.982**	.821*	.857*	.839*	.925*	.723*	.607	.814	.741*
7. Who shows the best overall leadership qualities?									
Model: S-D + MI	.902**	.688	.857*	.929**	.875	.741*	.964**	.557	.580
Alternative Model: Dir + MI	.821*	.634	.902**	.902**	.900**	.795*	.929*	.771	.759*

[a] $\underline{n} = 5$

[b] $\underline{n} = 6$

*$\underline{p} \geq .05$

**$\underline{p} \geq .01$

+ Videotape audio did not record precluding analysis of Group 5.

Table 3

Summary of the Cummulative Frequencies of
Rank Deviations for all Sociometrics

Sociometric & Model	Rank Deviations					
	0 - .5	1 - 1.5	2 - 2.5	3 - 3.5	≤4	Σdi^2
1. Whom would you go to for help on a tough problem?						
Model: L + MI	28	23	4	5	0	98.75
Alternative Model: L*	30	22	3	5	0	85.5
2. Who is pulling most for the group?						
Model: S-D + QVC*	38	14	4	3	1	89.5
Alternative Model: S-D	31	16	9	2	2	118.0
3. Who is best at handling people?						
Model: S-D + MI*	29	16	14	1	0	95.25
Alternative Model: S-D	28	16	14	2	0	98.5
4. Who has the most ability to think critically and analytically?						
Model: QVC + C/S	19	18	6	3	0	75.25
Alternative Model: QVC*	33	18	7	2	0	73.5
5. With whom can you work best?						
Model: MI	25	22	12	1	0	84.5
7. Who shows the best overall leadership qualities?						
Model: S-D + MI	30	21	6	2	1	89.5
Alternative Model: Dir + MI*	29	26	2	2	1	77.5

*Sum of squared deviations is least

Table 4

Spearman Rank Correlations for the Predictions of a Model With and Without Nonverbal Communications

With whom can you work best?

Model: Mutual Influence

Group[+]	Verbal (give and take)	Verbal & Nonverbal (dogmatic & aggressive)
1	.929**	.982**
2	.429	.821*
3	.857*	.857*
4	.839*	.839*
6[a]	.075	.925*
7	.384	.723*
8	.607	.607
9[b]	.243	.814
10	.489	.741*

[a] $n = 5$

[b] $n = 6$

*$p \geq .05$

**$p \geq .01$

+ Videotape audio did not record precluding analysis of Group 5.